

What is claimed is:

1. A watertight brushless fan motor comprising:

a circuit substrate fixed to a stator;

one or more electronic components mounted on the circuit substrate;

a rotor including a plurality of blades; and

a molded part formed of an insulating resin in such a manner that the stator, the one or more electronic components, and the circuit substrate are included therein;

the molded part expanding or shrinking to such an extent that electrical connection between the electronic components and circuits on the circuit substrate might be broken as it expands or shrinks due to a change in temperature, on an assumption that the molded part has been formed to directly cover the electronic components and the circuit substrate;

wherein the watertight brushless fan motor further comprises:

a protective layer provided at least between the one or more electronic components and the molded part, for preventing the breakage of electrical connection that might occur due to the expansion or shrinkage of the molded part; and

shear adhesion strength and thickness of the

protective layer are defined so that, when the expansion or shrinkage that might cause the breakage of electrical connection has occurred, separation between the one or more electronic components and the protective layer can be caused.

2. The watertight brushless fan motor according to claim 1, wherein the protective layer is formed to cover an entire surface of the circuit substrate including the one or more electronic components.

3. The watertight brushless fan motor according to claim 1, wherein the insulating resin for forming the molded part, which has been cured, has a shear adhesion strength of 30 kgf/cm² or more;

the protective layer is formed of an insulating material which has a shear adhesion strength of 15 kgf/cm² or less; and

the protective layer has a thickness in the range of 10 μm to 50 μm.

4. The watertight brushless fan motor according to claim 3, wherein the insulating resin for forming the molded part is made of an urethane resin; and

the protective layer is formed of a silicon resin.

5. The watertight brushless fan motor according to claim

1, wherein, in a portion of a surface of the molded part that faces the rotor, at least one concave portion is provided so as to be open toward the rotor and to receive the expansion of the molded part in order to prevent contact of the molded part with the rotor when the molded part has expanded.

6. A watertight brushless fan motor comprising:

a stator having a plurality of stator magnetic poles and comprising an iron core having a plurality of projecting pole portions and a winding wound around each projecting pole portion of the iron core;

the iron core being constituted from a plurality of laminated steel plates;

a circuit substrate fixed to the stator with a predetermined space provided between the circuit substrate and the projecting pole portions;

one or more electronic components mounted on the circuit substrate so as to constitute a control circuit for controlling current flowing through the windings;

a rotor including a plurality of rotor magnetic poles, each of which is made of a permanent magnet, on an inner peripheral side thereof and including a plurality of blades on an outer peripheral side thereof;

a case comprising an inner cylindrical section, a plate-like section, and an outer cylindrical section,

the inner cylindrical section including bearing for

rotatably supporting a rotary shaft of the rotor;

the plate-like section extending from an end of the inner cylindrical section in a direction perpendicular to a center line of the inner cylindrical section with a predetermined space provided between the plate-like section and the circuit substrate;

the outer cylindrical section extending in an axial line direction of the rotary shaft from an outer end of the plate-like section, along the inner cylindrical section; and

a molded part formed with an insulating resin in such a manner that the stator, the one or more electronic components, and the circuit substrate are included therein;

the molded part expanding or shrinking to such an extent that electrical connection between the electronic components and circuits on the circuit substrate might be broken as it expands or shrinks due to a change in temperature, on an assumption that the molded part has been formed to directly cover the electronic components and the circuit substrate;

wherein the watertight brushless fan motor further comprises:

a protective layer provided at least between the one or more electronic components and the molded part, for preventing the breakage of electrical connection that might occur due to the expansion or shrinkage of the molded

part;

the protective layer is formed of an insulating material having shear adhesion strength smaller than shear adhesion strength of the insulating resin that has been cured; and

the shear adhesion strength and thickness of the protective layer are defined so that, when the expansion or shrinkage that might cause the breakage of electrical connection has occurred, separation between the one or more electronic components and the protective layer can be caused.

7. The watertight brushless fan motor according to claim 6, wherein the protective layer is formed to cover an entire surface of the circuit substrate including the one or more electronic components.

8. The watertight brushless fan motor according to claim 6, wherein the insulating resin for forming the molded part, which has been cured, has a shear adhesion strength of 30 kgf/cm² or more;

the insulating material for forming the protective layer has a shear adhesion strength of 15 kgf/cm² or less; and

the protective layer has a thickness in the range of 10 μ m to 50 μ m.

9. The watertight brushless fan motor according to claim 8, wherein the insulating resin for forming the molded part is made of an urethane resin; and

the protective layer is formed of a silicon resin.

10. The watertight brushless fan motor according to claim 6, wherein, in a portion of a surface of the molded part that faces the rotor, at least one concave portion is provided so as to be open toward the rotor and to receive the expansion of the molded part in order to prevent contact of the molded part with the rotor when the molded part has expanded.

11. A watertight brushless fan motor comprising:

a stator having a plurality of stator magnetic poles and comprising an iron core having a plurality of projecting pole portions and a winding wound around each projecting pole portion of the iron core;

the iron core being constituted from a plurality of laminated steel plates;

a circuit substrate mounted with one or more electronic components constituting a control circuit for controlling current flowing through the windings;

the circuit substrate being fixed to the stator with a predetermined space provided between the projecting pole portions and the circuit substrate;

a rotor including a plurality of rotor magnetic poles,

each of which is made of a permanent magnet, on an inner peripheral side thereof and including a plurality of blades on an outer peripheral side thereof;

a case comprising an inner cylindrical section, a plate-like section, and an outer cylindrical section;

the inner cylindrical section including bearing for rotatably supporting a rotary shaft of the rotor;

the plate-like section extending from an end of the inner cylindrical section in a direction perpendicular to a center line of the inner cylindrical section with a predetermined space provided between the circuit substrate and the plate-like section;

the outer cylindrical section extending from an outer end of the plate-like section in an axial line direction of the rotary shaft, along the inner cylindrical section; and

a molded part formed with an insulating resin in such a manner that the stator, the one or more electronic components, and the circuit substrate are included therein;

wherein, in a portion of a surface of the molded part that faces the rotor, at least one concave portion is formed so as to be open toward the rotor and to receive expansion of the molded part in order to prevent contact of the molded part with the rotor when the molded part has expanded.

12. The watertight brushless fan motor according to claim 11, wherein the at least one concave portion comprises an annular groove formed so as to be adjacent to and run along the outer cylindrical section.

13. The watertight brushless fan motor according to claim 11 or 12, wherein the insulating resin for forming the molded part is made of an urethane resin.